Jan. 10, 1939. W. A. ABEGG 2,143,615

DRILL SLIP

Filed April 14, 1936

Fig. 1

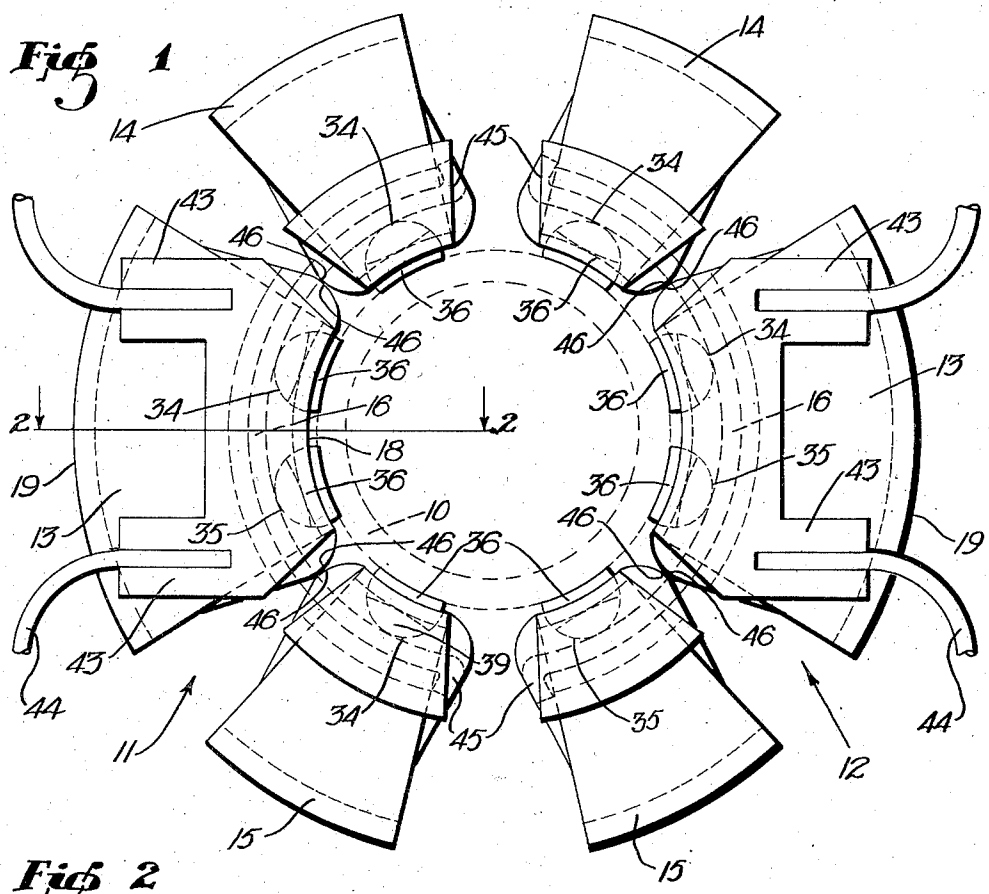
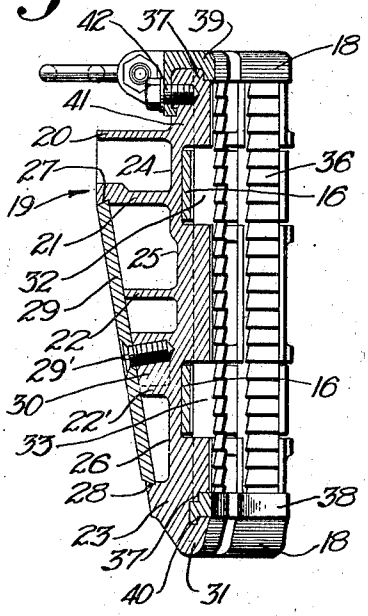


Fig. 2



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DRILL SLIP

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7 Claims. (Cl. 24—263)

This invention relates to well drilling equipment, and particularly pertains to a drill slip.

In drilling wells, and especially in drilling oil wells, it is common practice to provide means acting in combination with a rotary table of a well rig to grasp and hold the cylindrical member extending through the table, such for example as a drill pipe or casing. The devices used for this purpose are drill slips which are characterized as having a tapered back face adapted to wedge into a cooperating tapered seat, and a front face conforming to a portion of the circumference of the cylindrical member to be gripped, and being provided with gripping surfaces which penetrate the surface of the cylindrical member being gripped to hold the same. It is usual to provide four or more of these slips which are arranged around the member to be gripped and seated within the rotary table. These elements are cumbersome and awkward to handle, and due to their number make it necessary that some considerable time is required in placing the slips in position and removing them therefrom. It is the principal object of the present invention to provide a set of slips, preferably two in number, which are composite members including a plurality of slip sections assembled with each other to form a unit which may be bodily positioned or removed from their operative location in the rotary table, the separate elements of which are free to individually adapt themselves to a portion of the circumference of the member being gripped and to the seat in the rotary table, thus making it possible for two men to simultaneously work in placing separate composite slip units in position, or removing them therefrom in one operation for each slip unit so that drilling operations may be rapidly carried on and so that only two slip units must be handled in setting the slips or in removing them from their seated and gripping positions.

The present invention contemplates the provision of a drill slip unit comprising a plurality of separate slip sections yieldably connected to each other so that they may be handled as a one composite unit, the individual sections being fitted with gripping faces adapted to assume gripping positions within the seat on a rotary table, and around the circumference of a cylindrical member to be gripped and in conformity thereto.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a view in plan showing two of the slip units with which the present invention is concerned, as said units appear in their gripping position around a cylindrical member to be held thereby.

Fig. 2 is a view in section through a slip unit as seen on the line 2—2 of Fig. 1.

Referring more particularly to the drawing, 10 indicates a drill pipe or other cylindrical member to be gripped by slips in a rotary table. 11 and 12 indicate duplicate slip units comprising a central slip element 13 and end slip elements 14 and 15. In the form of the device shown in Fig. 1 of the drawing, the slip elements are yieldably connected by a lock spring 16. This spring is made of steel and is tempered so that the slip elements 13 to 15, inclusive, may have radial yieldability with relation to a cylindrical member to be gripped. In the device shown in Figs. 1 and 2 of the drawing the central slip element is cast and is formed with an arcuate inner face 18 struck from a center point substantially agreeing with the center of the rotary table when the slip unit is seated therein. Thus the face will be concentric to a cylindrical member extending through the unit. The back of the casting generally indicated at 19 is formed with a plurality of horizontally extending webs 20, 21, 22 and 23, which are spaced from each other and progressively increase in horizontal width from the lower web 23 to the upper web 20. These webs are connected by vertical web sections 24, 25 and 26. Thus it will be seen that the main casting of the slip element 19 has considerable strength, but is relatively light in weight, as shown in my Patent No. 2,010,938, issued to me August 13, 1935, and entitled Light weight slip.

The webs 21 and 23 have opposing horizontal faces which are inclined inwardly and in opposite directions as indicated at 27 and 28, and into which wear plates 29 fit. The wear plates are arcuate in horizontal section and rest against the webs 22 and a web 22', where they are secured in position by screws 29' which extend into bosses 30 occurring between the horizontal webs 22 and 22', and at a point in the length of the central vertical web 25. The lower ends of the casting 19 are formed with a rounded nose portion 31 which makes it possible for the slips to be easily introduced into the space between the member to be gripped and the seat in the rotary table. The inner arcuate face 18 of the casting 19 is shown in Fig. 2 as being formed with a pair of horizontally extending grooves 32 and 33 spaced from each other along the length of the casting 19 and into which the lock springs 16 seat. These springs are of a vertical width substantially

equaling that of the grooves into which they fit and are of a horizontal thickness which permits the lock spring 16 to flex in a horizontal plane. Formed longitudinally of the arcuate faces 18 of the casting 19 are a pair of arcuate semi-circular grooves 34 and 35 which are spaced from each other and which receive inserts 36. These inserts are of relatively hard metal and are formed with teeth, the biting edges of which face upwardly. The opposite ends of the inserts are formed with arcuate tangs 37, the lower tangs being held by a bottom retaining member 38 and the upper tangs being held by a top retaining member 39. These members have overhanging lips in the rear of which the tangs seat and with relation to which they have limited rotational movement around the axis describing their outer arcuate surface. The lower retaining member interlocks with the casting 19 due to an outer downturned lip 40. The upper retaining member extends over the upper face of the casting 19 and conforms to the outer face of an extension 41 where it is secured in position by cap screws 42. The upper retaining member 39 is formed with sets of ears 43 which receive handles 44 by which the entire slip unit may be lifted and manipulated. The lock spring 16 extends horizontally beyond the opposite sides of the central slip element 13 and across grooves 32 and 33 in the slip elements 14 and 15 where it is held by the slip inserts. The opposite ends of the lock spring are bent outwardly as indicated at 45 to retain the slip elements 14 and 15 in assembled relationship at opposite sides of the central slip element 13. The contiguous faces of the central slip element 13 and the opposite slip elements 14 and 15 are formed at points in their length with horizontally extending ribs 46 which have arcuate faces in constant contact so that as any flexure takes place in the lock spring due to relative movement of the slip elements with relation to each other and the cylindrical member they are gripping, the elements will move with relation to each other along the arcuate faces of the ribs 46 and will retain their compactly assembled relationship.

In the use of the structure here shown and described the slip units are assembled as indicated in Fig. 1 and will comprise the central slip element 13 and the two slip elements 15 and 16. After the inserts 36 have been positioned within their seats 35 and are held by the lower fastening elements 38 and the upper fastening elements 39 the slip units with their handles 44 are in a condition to be used. The units may be dropped into the seat of the rotary table so that their wear plates 29 will conform to the face of the rotary table seat and so that the slip elements may move downwardly into the annular space occuring between the cylindrical member to be gripped and the inserts 36. As this wedging action takes place the slips 13, 14 and 15 will arrange themselves around the portion of the cylindrical member being gripped and will insure that the various inserts 36 will properly conform to the contour of these faces to obtain a uniform gripping action by each of the slip inserts carried by a slip unit which includes the central slip element 13, and the companion slip elements 14 and 15. When it is desired to remove the slip inserts from their gripping position the handle may be grasped and the entire slip unit, including the three sections, may be instantly lifted from its seated position. It will be understood that while the invention has been described and explained as including three slip elements that any plurality of slip elements may be used which is found convenient.

Attention is directed to the fact that a very convenient and desirable assembly of the structure shown in Fig. 1 is effected due to the fact that the slip inserts 36 extend vertically and bridge the recess within which the yieldable springs 16 are held. Thus when the upper retaining member 39 is pulled into position to retain the slip inserts 36 in their operative positions the springs 16 will be held assembled so that the units 13, 14 and 15 will retain their assembled position without additional fastenings.

It will thus be seen that by the arrangement here disclosed the handling of a plurality of drill slips during drilling operations is eliminated, thus making it possible for the setting and removing of drill slips to be rapidly and conveniently accomplished by a simple and efficient structure.

While I have shown the preferred form of my invention, as now known to me, it will be understood that various changes might be made in the combination, construction and arrangement of parts, by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A drill slip unit comprising a central drill slip element, a pair of drill slip elements one disposed on each side of said central element, each of said elements carrying means having rotational movement therefor adapted to engage and grip a drill pipe or the like, and common means vertically rigid and radially yieldable connecting the pair of elements to the central element whereby the several gripping means may assume radial positions conforming to the surface of the drill pipe while being held against relative vertical movement.

2. A drill slip unit comprising a central drill slip element, a pair of drill slip elements one disposed on each side of said central element, each of said elements carrying means having rotational movement therefor adapted to engage and grip a drill pipe or the like, and common means yieldably connecting the pair of elements to the central element whereby the several gripping means may assume positions conforming to the surface of the drill pipe, said means including arcuate spring members struck from a radius, the center of which substantially agrees with the center of the drill pipe and upon which member said slip elements are carried and said spring having locking means forming a part thereof whereby said sections will be held in assembled relation with each other.

3. A drill slip unit comprising a central drill slip element, a pair of drill slip elements one disposed on each side of said central element, each of said elements carrying means having rotational movement therefor adapted to engage and grip a drill pipe or the like, common means yieldably connecting the pair of elements to the central element whereby the several gripping means may assume positions conforming to the surface of the drill pipe, said means including arcuate spring members struck from a radius, the center of which substantially agrees with the center of the drill pipe and upon which member said slip elements are carried and said spring having locking means forming a part thereof whereby said sections will be held in assembled relation with each other, and means formed on

the contiguous faces of the slip elements and in contact with each other whereby said elements will be retained in contacting engagement as they move with relation to each other.

4. A drill slip unit comprising a plurality of drill slip elements, each of said elements being formed with a transverse recess in its inner arcuate face, an arcuate spring member having locking means forming a part thereof lying in said transverse recess and holding various elements in assembled relation to each other, said spring member being vertically rigid and radially yieldable and a plurality of drill slip inserts disposed longitudinally in the inner arcuate faces of each of the drill slip elements and bridging the transverse recess to hold the spring member in assembled relation to the various drill slip elements.

5. A drill slip structure comprising a central drill slip element and a pair of end drill slip elements between which the central element is disposed, arcuate faces formed along contiguous abutting edges of said elements whereby the elements may move horizontally with relation to each other along said faces, and arcuate spring having locking means forming a part thereof associated with all of said drill slip elements and yieldably holding them with their contiguous arcuate faces in contact.

6. A drill slip structure comprising a plurality of drill slip elements, each having a tapered back face adapted to seat in a rotary table and a straight vertical front face horizontally curved to conform substantially to the circumference of a drill pipe, said front face having transverse recesses thereacross and vertical grooves thereon, arcuate spring members, one disposed in each series of transverse recesses of the slip elements, the opposite ends of said springs carrying limiting means to prevent longitudinal shifting movement of the springs, and slip inserts held in the longitudinally extending grooves of the slip elements and bridging the transverse grooves in a manner to hold the slip elements and the arcuate springs in assembled relation to each other.

7. A drill slip unit comprising a central drill slip section, a pair of drill slip sections disposed on each side of the central section, the three sections being radially arranged with relation to a common center, arcuate bearing faces carried upon the contiguous vertical edges of said sections and constantly in contact whereby said arcuate surfaces may roll with relation to each other, and an arcuate spring element engaged by each of the said sections and holding the sections in assembled relation to each other, said spring element being vertically rigid and being radially yieldable.

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